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#### LYMAN J. BRIGGS ELECTED VICE CHAIRMAN OF THE NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

At the recent annual meeting of the National Advisory Committee for Aeronautics, Dr. Lyman J. Briggs was unanimously elected vice chairman for the ensuing year.

Dr. Briggs was appointed a member of the Committee by President Roosevelt in 1933 and has served continuously since that date. He is chairman of two of the five subcommittees of the NACA—the committee on aircraft structures and the committee on materials for aircraft. His work in aerodynamics is the subject of three of the Committee's Technical Reports. He has had much to do with coordinating the work of the NACA and the Bureau and with the planning of investigations conducted by the Bureau at the Committee's request.

#### HUGH L. DRYDEN ELECTED PRESIDENT OF INSTITUTE OF THE AERONAUTICAL SCIENCES

Dr. Hugh L. Dryden, chief of the Bureau's Mechanics and Sound Division, was elected president of the Institute of the Aeronautical Sciences at the annual meeting in New York on December 1.

For 24 years Dr. Dryden has been closely connected with aeronautical research at the Bureau, particularly in the field of aerodynamics. His contributions to knowledge of the laws governing air flow have had an important influence on the design of aircraft.

In 1933 the Institute chose Dr. Dryden to deliver the annual Wright Brothers Lecture. His subject was "Turbulence and the Boundary Layer" (Technical News Bulletin 261; January 1939). At the Honors Night dinner on January 28, 1941 he received the Sylvanus Albert Reed award for notable

<sup>1</sup> Published with approval of the Director of the Budget.

contributions to the science of aeronautics.

### WARTIME REVISION OF CODE FOR ELECTRICITY METERS

For more than three decades the Code for Electricity Meters has been the generally recognized standard of practice in the art of metering electric energy. Originally issued in 1910 by the joint action of the meter committees of the National Electric Light Association and the Association of Edison Illuminating Companies, the code has been revised from time to time, the latest extensive revision having been completed in May 1941 under ASA Sectional Committee procedure, with the Bureau, the Association of Edison Illuminating Companies, and the Edison Electric Institute as joint sponsors. The code has formed a guide for the official regulations promulgated by the public utility commissions of many States, and in some States has been adopted in toto. One of the many practices recommended in the code is a suggested schedule for the periodic testing and readjustment of watt-hour meters.

The flow of manpower to war industry and to the Army has left the utility meter departments with depleted staffs of skilled testers. Limitations on gasoline and rubber are further reducing the number of meters per day which a single tester can handle. It therefore appeared desirable, if it were technically advisable, to reduce the burden of meter testing by increasing the permissible interval between tests of the smaller sizes of meters, particularly those in residences, which constitute the great bulk of the meters in use.

At the suggestion of the EEI and the AEIC, Sectional Committee C12 was constituted a War Standards Committee for this purpose and certain vacancies in its membership were filled. The question was first referred to a subcommittee consisting of F. E. Davis, Commonwealth & Southern Corporation; P. L. Holland, Public Utilities Commission of Maryland; R. H. Nexsen, Public Service Commission of New York; L. D. Price, Public Service Electric & Gas Co.; A. R. Rutter, Westinghouse Electric & Manufacturing Co.; and F. B. Silsbee, National Bureau of Standards, chairman.

Fortunately, data were obtained by Mr. Price and from the records of the Department of Public Service, State of Washington, on the performance of several thousand meters over long pe-

riods of time. An examination of these data showed that the drift in calibration of the great majority of these meters had been very slight and that the number drifting fast was about offset by an equal number which became slow.

It was therefore decided, without dissenting vote in either the subcommittee or the main committee, that the interval between tests of a-c meters rated at 12 kilovolt amperes and less could be extended to 8 years without danger of doing an injustice to either the power companies or their customers. This revision was approved November 5, 1942, as an American War Standard. The official designation is C12 WS-1942. Copies of the revised section of the code can be obtained from the American Standards Association, 29 West 39th Street, New York, N. Y.

### ELECTRODE HOLDER FOR SPECTROGRAPHIC ANALYSIS

The spectrographic analysis of metals, refractories, and other materials has replaced the older chemical methods in many cases, particularly in control or inspection testing. The advantages of the newer method are higher sensitivity of detection of metallic elements, improved precision, and greater speed. To realize the full potentialities of the spectrographic method, attention has been given to improving both the procedures and the design of equipment. One of the operations in this method, which not only involves time-consuming manipulation but also some danger to the operator, is the excitation of electrode samples. This operation involves volatilization of metallic vapors into the electric arc or the electric spark with potentials which may be as high as 40,000 volts. An electrode holder, designed by Bourdon F. Scribner and Charles H. Corliss and built in the Bureau's shop, meets more rigid requirements of speed and safety in general spectrographic testing. As described and illustrated in the January Journal of Research (RP1515), the holder consists of water-cooled precision-acting copper clamps mounted on rigid ways and equipped with various controls designed for rapid and positive action. The controls are operated outside of a grounded safety housing which serves to protect the operator against harmful radiations, fumes, and electric shock. The holder has proved useful in speeding up a variety of spectrographic analyses of importance to the war effort and, at the same time,

has afforded greater precision and safety.

### ELEVATOR WIRE-ROPE MAINTENANCE

The maintenance of wire rope used for elevators, with special reference to war conditions, is discussed in Circular C441 which has just been released. This Circular was compiled by John A. Dickinson of the Bureau's safety codes' section and represents the views of the Executive Committee for the American Standard Safety Code for Elevators, Dumbwaiters, and Escalators. It covers the items affecting the life of wire rope, such as lack of lubrication, unequal tensions, misalignment of sheaves, inadequate maintenance of sheave grooving, poor brake setting, unduly high peaks of acceleration and retardation, and changes in top and bottom hoistway clearances. Methods of checking and correcting these particular items are discussed, and the publication closes with a suggestion that rope life be extended by decreasing elevator service either by running fewer cars or by establishing skip stops, or by similar methods.

Copies of C441 are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C. The price is 5 cents.

### THERMAL EXPANSION OF SOME BRONZES

Results obtained in the course of independent tests and investigations on the linear thermal expansion of four groups of copper-base alloys designated as tin-zinc, leaded, aluminum, and silicon bronzes are tabulated in a paper by Peter Hidnert (RI'1518) in the January number of the Journal of Research. Curves showing the typical expansion and contraction behavior of these bronzes during heating and cooling are presented.

Ternary diagrams are given for the copper-tin-zinc and copper-tin-lead alloys to show the effect of composition on the coefficients of expansion. In general, the coefficients of expansion of these copper-base alloys increase as the addition of tin, zinc, or lead is increased.

Table 3 of the paper gives a summary of the coefficients of expansion of various bronzes for three temperature ranges. For the range 20° to 100° C, the average coefficients of expansion were found to be between  $16.8 \times 10^{-6}$  and  $19.0 \times 10^{-6}/^{\circ}\text{C}$ . The maximum coef-

ficient of expansion was found to be  $64 \times 10^{-6}/^{\circ}\text{C}$  between 900° and 1,000° C for a silicon bronze.

### FIRE-RESISTANCE CLASSIFICA- TION OF BUILDING CONSTRUCTION

One of the basic objects of public regulation of building construction is to secure reasonable safety from fire. Regulations relating to the construction and spacing of buildings are founded on long community experience with fire as a destructive agent. Many of the older cities and ruins of cities that are found today are overlaid by the ruins of still older cities, in the destruction of which fire played an important if not a sole part. Within comparatively recent times many cities have been practically leveled by fire, and such safety as now obtains has been achieved in considerable part as the result of this experience. Individual occupants of buildings are vitally interested, because fire can, with startling suddenness, transform a friendly shelter into a place from which one must flee at the peril of one's life.

As the result of this experience with fires, a type of building has been developed which is generally designated as fireproof. It can withstand a complete burn-out of contents without collapse of structural members, although these, as well as the building finish and trim, will be damaged in fires of any considerable intensity and duration. For buildings with the lighter amounts of combustible contents, the spread of fire will be retarded and structural fire barriers can be provided that will generally confine even very severe fires within given areas. The hazard to neighboring construction from fires in such buildings is comparatively small, and they have often acted as barriers to the spread of conflagrations.

In Building Materials and Structures Report BMS92 on the fire-resistance classification of building construction, it is assumed that "fireproof" buildings will be constructed in a considerable range of fire resistance appropriate to the hazard presented by their occupancy and contents. A method is given for evaluating the fire severity to which buildings may be subjected, in terms of the amount of combustibles which they contain. Greater economy and safety are thus made possible than would be the case if a fixed degree of fire resistance were required — too high for low-hazard occupancies of residential type, and insufficient to withstand the severe

fires that can occur in mercantile, factory, and storage buildings. The recommendations are supplemented with data on fire-resistance ratings of floors, walls, columns, and other members, which afford a considerable range in choice of constructions that will withstand a given fire severity.

The second type of construction defined in BMS92 has incombustible interior and exterior construction. Its fire resistance is limited to ability to withstand a severe fire for  $\frac{3}{4}$  hour. With light-hazard occupancies, no collapse of structural members is likely to occur even if fires are not extinguished, and the same holds for potentially severe fires controlled in their early stages. Where collapse occurs it would be likely to pull the exterior walls toward the inside, and the incombustible floor and roof would tend to blanket the fire.

The third type, termed exterior-protected, comprises buildings with exterior masonry walls and interior wood construction. The outside walls with protected openings are effective in preventing the spread of fire from building to building for all but very severe exposures. In common with the preceding type, the interior construction can, without much difficulty, be made to have a fire-resistance rating of  $\frac{3}{4}$  hour, although as for the other type, buildings with lower fire resistance are recognized as coming within the group. This type of building has served acceptably in preventing sweeping conflagrations, where the general size of buildings involved and amount of combustible contents were not too large.

The remaining type includes buildings with wood exterior and interior construction. As with the two preceding types, the fire resistance of their structural members can be increased till it is appreciably above that of unprotected members. Incombustible veneers that can be applied to outside walls will give resistance to exterior fire exposure approaching that of exterior-protected type of construction.

The bases for restrictions and limitations are outlined from the standpoint of fire zoning, height and area of building, distance from lot line or adjacent buildings, permissible materials and occupancies, and required degree of fire resistance, and are discussed in their relation to the different types of construction. No definite recommendations are made concerning these particulars. They can best be settled for each municipality after considering local conditions. The report includes a sum-

mary of such restrictions and limitations as they are applied in six typical building codes.

Copies of BMS92 are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C. The price is 25 cents.

### MOISTURE IN WALLS OF FRAME HOUSES

The widespread application of air conditioning to houses to promote better health and comfort has brought a problem in building construction. Vapor from the warm, humidified inside air enters the walls and often accumulates there during cold weather to an extent that may cause serious damage. The Bureau has studied the problem in cooperation with the Insulation Board Institute, by actually observing what took place inside the north wall of a frame house during winter weather while a relatively high humidity was maintained inside the house. Seven different constructions were exposed simultaneously as adjacent full-height sections of the wall.

As explained in Building Materials and Structures Report BMS93, copies of which are now obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each, condensation within walls can be avoided by using a vapor barrier to prevent the moisture from entering the walls from the warm side. In instances where this type of protection was not employed, condensation occurred during an exposure of 2-weeks duration in Washington, D. C. during moderate winter weather. There was no basic difference between the performance, with respect to the accumulation of moisture, of walls of standard wood construction and those in which fiber sheathing boards were used. In all instances of condensation, the accumulation of moisture was greatest in the lower portions at or near the sills, where decay would be a serious matter.

### PAINTS AND OTHER PROTECTIVE COATINGS FOR TIRES

Letter Circular LC709, released last month, answers questions frequently received by the Bureau concerning tire paints.

These paints and other protective coatings may serve to improve the appearance of tires and to protect the rubber from cracking and checking caused by sunlight and weather, but no products are known that will restore or

rejuvenate old rubber or increase the mileage of treads.

Materials offered for use on tires can be tested by applying them to alternate sectors of tires and comparing the treated and untreated areas after a reasonable mileage. A product to be worth testing on the road should form a waterproof, adherent film or should be absorbed by rubber.

It is recommended that tires having white sidewalls and the tires of unused vehicles exposed to the weather be painted for protection. When protection is needed against radial cracks or severe checking of the sidewalls a solution of an antioxidant and a sun-checking inhibitor should be applied. The large majority of tires, however, require no treatment beyond intelligent care and maintenance.

### REACTION OF WOOL WITH ALKALI

One of the most characteristic chemical properties of wool is the ease with which it is degraded in alkaline solutions. The effect of alkalis on wool has accordingly received considerable attention over a period of years by the Research Associates of the Textile Foundation stationed at the Bureau. In the January number of the Journal of Research (RP1516), Louis R. Mizell and Milton Harris report the results of further work in this direction.

It was found that such degradation is closely associated with the destruction by alkali of the disulfide groups of the cystine of the wool. Since these groups act as cross-links in the molecular structure, thereby contributing considerably to the wet strength and to the long-range elastic properties of the fiber, the necessity for keeping them intact is at once obvious.

The reaction of the disulfide groups with alkali results in the rupture of the cross-links, followed by the loss of one sulfur atom from each molecule of cystine. It appears that at least a part of the residual sulfur groups in the ruptured cross-links are capable of forming a new type of cross-link, thus partially stabilizing the system.

### MECHANICAL PROPERTIES OF CELLULOSE ACETATE

Textile fibers must meet certain specifications as to mechanical properties, such as strength, flexibility, or resiliency. The more important fibers owe their individual successes to the possession, to a greater or less extent, of

certain of these desirable characteristics. It has been shown by many investigators that these properties are related to the length, arrangement, and chemical nature of the chain-like molecules of which the fibers are composed. The investigation reported in RP1513 (January Journal of Research) by Arnold Sookne and Milton Harris, Research Associates of the Textile Foundation, is concerned with only the first of these factors, namely, the influence of the length of molecules. The material used was cellulose acetate which had been carefully fractionated with respect to molecular chain-length. The average length of the chains in the fraction containing the longest molecules was roughly 10 times that of the chains in the fraction containing the shortest.

It was found that the fraction of lowest chain-length would not form a coherent film; fractions of longer chain-length formed films which showed rapid improvement in mechanical properties with increasing chain-length; however, with the fractions of greatest chain-length, further improvement was only slight. When blends of the fractions were investigated, it was found that inclusion of fractions of shorter chain-lengths exerted a harmful effect on the mechanical properties of the films. This is consistent with the concept that structures of such materials fail when a sufficient number of chain ends appear close together. Obviously, the number of ends in any cross section of a sample increases as the average chain-length decreases.

### PHOTOCHEMICAL STABILITY OF PAPERS

Light has an important effect on papers. The conditions under which exposure takes place usually involve room temperatures and sky light transmitted by glass windows. To simulate these conditions, while studying the photochemical stability of papers, Herbert F. Launer and William K. Wilson used a powerful light source provided with a special filter to remove the objectionable portions of the ultraviolet and infrared ends of the spectrum. During irradiation the papers were maintained near 30° C. and a normal humidity. Thus the heat effects which have been shown to overshadow light effects under ordinary experimental and testing conditions involving high intensity sources, were eliminated.

As shown in the Journal of Research for January (RP1517), the results ob-

tained differ considerably from those of previous workers. The yellowing of papers (containing little or no lignin) commonly ascribed to light was found to be a result of heat effects or age, but not of light; when heat effects were eliminated during irradiation, all the papers were bleached by light. Even highly lignified paper, such as newsprint, was bleached by light in the absence of oxygen.

Paper scorched brown at high temperatures or yellowed at 100° C, and papers 250 years old and very yellow were bleached by light in the absence of heat effects.

It was found that lack of oxygen inhibits photochemical deterioration, but does not prevent it altogether. Lack of water vapor decreased the rate of alpha-cellulose change in papers made from wood pulps, but increased the rate in those derived from cotton. The rate was found to be proportional to less than the first power of time of irradiation and of light intensity.

Under normal conditions the order of the photochemical stability of papers made from various kinds of fibers was as follows, starting with the most stable: New cotton rag, refined sulfite, old cotton rag, soda-sulfite mixtures, and newsprint. The stability of new-rag papers was greatly affected by acid and rosin, whereas that of old rag and soda-sulfite was only slightly affected. This is in marked contrast to heat stability, for which the pH is important for all fibers. Newsprint, made neutral with  $\text{NaHCO}_3$ , showed a large increase in light stability. Rosin did not seriously affect the light stability of new-rag papers, as long as the acidity was low. Little difference between ordinary rosin and hydrogenated rosin was found in this connection. Any effect of glue and starch sizing could be ascribed to the acid of the sizing bath. Fillers had no significant effect.

Lignin was found to render paper very unstable to light, and was itself converted to acid substances, the acidic nature of which probably plays no direct part in the photochemical deterioration. Lignin had a greatly diminished effect at low concentrations of oxygen.

Certain dyes were found to increase deterioration by light. Printers' ink extensively protected the paper beneath it.

Papers once irradiated were found to be subsequently less stable in the dark than those not previously irradiated.

## INDEX TO REPORTS OF NATIONAL CONFERENCES ON WEIGHTS AND MEASURES

Almost every problem of weights and measures administration and many related subjects have been discussed and acted upon at one or more of the 31 National Conferences on Weights and Measures that have been held, beginning in 1905, under the auspices of the National Bureau of Standards. The report of each Conference has been published by the Bureau, but the difficulty of locating any particular item would be very great if one were obliged to search through each of these 31 reports.

To make the Conference reports of maximum utility to enforcement officers, manufacturers, and others interested in weights and measures, a complete index of the subjects covered has been prepared by Ralph W. Smith and William T. McCormac, of the Bureau, and is now available as Miscellaneous Publication M172. The index is in two parts, arranged first by subjects and second by speakers. In addition, a short table gives the status (still for sale or out of print) of the Conference reports from 1905 to 1941.

Copies of M172 are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C. The price is 10 cents.

## TABLE OF HYPERGEOMETRIC AND LEGENDRE FUNCTIONS

Table MT15 of the mathematical series, which the Bureau is sponsoring, was compiled by Chester Snow of the Electricity Division for workers in applied mathematics. Its scope is intermediate between tables of numerical values of these functions and a treatise on their pure theory. The linear and quadratic transformations and analytic continuations of the ordinary hypergeometric function are derived and written out at length, with special space devoted to the general associated Legendre functions, and to a smaller extent Heun's generalization of the hypergeometric function. Applications to potential theory (91 pages), where the potential is given on surfaces of revolution, include most of the elementary separable coordinate systems. Use is made of the potential equation in a form invariant to inversions, and from the point of view of integral equations with Legendre's function,  $Q_m-1/2$ , of the second kind as nucleus. Some general-



izations of Fourier's integral are obtained in which the development function satisfies a second-order differential equation of rather general form. These are utilized in obtaining the formal solution of various potential problems. A set of normal functions is constructed, satisfying the Lamé-Wangerin equation in "annular" coordinates, which include toroidal coordinates and oblate spheroidal as limiting cases.

The publication was reproduced by the photooffset process from original handwritten manuscript. It contains 319 pages, bound in heavy paper covers. The price is \$2.00. Remittances should be made payable to "National Bureau of Standards."

# NEW AND REVISED PUBLICATIONS ISSUED DURING DECEMBER 1942

## Journal of Research<sup>2</sup>

Journal of Research of the National Bureau of Standards, volume 29, number 6, December 1942 (RP1507 to RP1512, inclusive). Price 30 cents. Annual subscription, 12 issues, \$3.50.

## Research Papers<sup>2</sup>

[Reprints from October 1942 Journal of Research]

RP1500. Dependence of the indigestibility of wool protein upon its polymeric structure. Walton B. Geiger and Milton Harris. Price 5 cents.

RP1501. Perforated cover plates for steel columns: Compressive properties of plates having ovaloid perforations and a width-to-thickness ratio of 68. Ambrose H. Stang and Martin Green-span. Price 10 cents.

RP1502. A reexamination of the Potsdam absolute determination of gravity. Hugh L. Dryden. Price 5 cents.

RP1503. Catalyzed hydrolysis of amide and peptide bonds in proteins. Jacinto Steinhardt and Charles H. Fugitt. Price 5 cents.

## Circulars<sup>2</sup>

Supplement to C398. Standard samples issued or in preparation by the National Bureau of Standards. (Descriptive list.) Free on application to the Bureau.

# Building Materials and Structures Reports<sup>2</sup>

[Persons who wish to be notified of new publications in the Building Materials and Structures series as soon as they are available should write to the Superintendent of Documents, Government Printing Office, Washington, D. C., asking that their names be placed on the special mailing list maintained by him for this purpose.]

BMS92. Fire-resistance classifications of building constructions. Report of Subcommittee on Fire - Resistance Classifications of the Central Housing Committee on Research, Design and Construction. Price 25 cents.

BMS93. Accumulation of moisture in walls of frame construction during winter exposure. Charles G. Weber and Robert C. Reichel. Price 10 cents.

## Simplified Practice Recommendations<sup>2</sup>

R48-42. Shovels, spades, scoops and telegraph spoons. Price 5 cents.

R86-42. Surgical gauze. Price 5 cents.

R158-42. Forged axes. Price 5 cents.

R159-42. Forged light hammers. Price 5 cents.

R160-42. Forged hatchets. Price 5 cents.

## Commercial Standards<sup>2</sup>

CS103-42. Cotton and rayon velour (Jacquard and plain). Price 5 cents.

## Miscellaneous Publications<sup>2</sup>

M172. Index to the reports of the National Conference on Weights and Measures, from the first (1905) to the thirty-first (1941), inclusive. Ralph W. Smith and William T. McCormac. Price 10 cents.

## Technical News Bulletin<sup>2</sup>

Technical News Bulletin 308, December 1942. Price 5 cents. Annual subscription, 50 cents.

<sup>2</sup> Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents a year; Journal of Research, \$3.50 a year (to addresses in the United States and its possessions and to countries extending the franking privilege); other countries, 70 cents and \$4.50, respectively.

# **RECENT ARTICLES BY MEMBERS OF THE BUREAU'S STAFF PUBLISHED IN OUTSIDE JOURNALS\***

Defense against bombing. S. H. Ingberg. Safety Engineering (Best Building, 75 Fulton St., New York, N. Y.) 84, No. 5, 24 (Nov. 1942).

Hydrocarbons in petroleum. Frederick D. Rossini. Record of Chemical Progress (c/o Neil E. Gordon, Editor, Wayne University, Detroit, Mich.) 3, 53 (1942).

Method for analyzing the gasoline fraction of petroleum, with preliminary results on East Texas and Oklahoma crudes. Frederick D. Rossini, Beveridge J. Mair, Alphonse F. Forzlati, Augustus R. Glasgow, Jr., and C. B. Willingham. Proc. Am. Petroleum Inst. (50 West 50th St., New York, N. Y.) 23, III (1942); Oil and Gas J. (Tulsa, Okla.) 41, No. 27, 106 (1942); Petroleum Refiner (Gulf Publishing

Co., 330 Buffalo Drive, Houston, Texas) 21, No. 11, 73 (1942).

Simplification in wartime. Edwin W. Ely. Mid-Continent Purchaser (315 Tulsa Building, Tulsa, Okla.) 22, No. 21, 1 (Nov. 1, 1942).

## **MIMEOGRAPHED MATERIAL**

### **Letter Circulars**

[Letter Circulars are prepared to answer specific inquiries addressed to the National Bureau of Standards, and are sent only on request to persons having a definite need for the information. The Bureau cannot undertake to supply lists or complete sets of Letter Circulars or send copies automatically as issued.]

LC706. Devices for air raid warnings. (Supersedes LC685.)

LC707. Rubber: List of publications by members of the staff of the National Bureau of Standards. (Supersedes LC634.)

LC709. Paints and other protective coatings for tires.

LC710. Some physical properties of butadiene and styrene.

\* These publications are not obtainable from the Government. Requests should be sent direct to the publishers.



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